
ENVIRONMENTAL Fact Sheet



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Naphthalene: Health Information Summary

Naphthalene is found as either a white crystalline solid or in liquid form. Its distinctive odor is best described as “mothballs,” since that product is made of naphthalene. Naphthalene is used in the manufacture of plastics, dyes, resins and pharmaceuticals. In addition to its use in the home as a moth repellent and in toilet deodorant blocks, naphthalene is formulated in the insecticide carbaryl, which has both commercial and residential uses. Burning tobacco, wood or petroleum products produces naphthalene.

Because naphthalene is one of the many compounds found in petroleum, it will frequently be detected as a contaminant in soil or groundwater where there has been a release of gasoline or a fuel oil. When testing for residential indoor air quality is conducted, the potential for naphthalene to serve as a background source of contamination should be taken into account because it is commonly found in homes as mothballs and naphthalene slowly vaporizes at room temperature.

Naphthalene’s odor can be detected in the air at around 84 parts per billion (ppb) and in water at around 21 ppb.

Health Effects

Absorption

There are no studies available to determine the percentage of naphthalene absorbed by the possible exposure routes. It is fairly certain that there is some absorption through the skin because of reports of hemolytic anemia in babies who wore naphthalene-treated diapers. Naphthalene can cross the placenta resulting in anemia in newborns if the mother’s exposure is high enough. Most absorbed naphthalene is eliminated by the body within one to three days after exposure, but a small percentage may be stored in fat tissue.

Short-Term (Acute) Effects

Short-term oral or inhalation exposures indicate that high doses of naphthalene can cause eye damage such as cataracts, hemolytic anemia due to destruction of red blood cells, and damage to the liver and kidney. Some deaths have been reported from high-level exposure, mainly due to severe hemolytic anemia. Some of the symptoms of hemolytic anemia include fatigue, lack of appetite, restlessness, and pale skin. Individuals with conditions that affect the oxygen carrying capacity of the blood are more susceptible to the effects of agents such as naphthalene, which cause red blood cells to disintegrate. The genetically inherited condition in which individuals have a deficiency in the enzyme glucose-6-phosphate dehydrogenase (G6PD) makes them more susceptible to hemolytic anemia and, therefore, to chemicals such as naphthalene. Populations with African, Asian or Mediterranean ancestry have a higher frequency of G6PD deficiency than those of European ancestry. Infants are another population known to be sensitive to naphthalene-induced anemia because their metabolism has not completely developed.

Hemolytic anemia has been reported in infants exposed dermally to naphthalene treated diapers or clothes.

Inhalation exposures can irritate the eyes, nose, and throat. Inhalation of vapors from mothballs caused nausea, vomiting, and abdominal pain in some individuals. Gastrointestinal disorders are also common in humans after oral exposure.

Long-Term (Chronic) Effects

Animal studies have shown cataract formation from long-term naphthalene exposure; some limited human evidence has supported this finding. Other effects seen in animals after long-term naphthalene exposure include nose and lung irritation from inhalation exposure, effects to the spleen and thymus from oral exposure, and pathological changes in the lung from both oral and inhalation exposure.

Carcinogenic (cancer-causing) Effects

There is no human evidence that naphthalene is a carcinogen. Although the results in a few animal studies did not find any increase in cancer with naphthalene exposure, one study did find male and female rats exposed by inhalation to naphthalene had increases in tumors of the nose and female mice had an increased incidence of benign lung tumors. There are no animal studies by the oral exposure route that demonstrated an increased cancer risk. Under the previous US Environmental Protection Agency cancer guidelines, naphthalene was classified in Group C as a “possible human carcinogen.” Under the recent cancer guidelines update, naphthalene has been classified into the group “inadequate information to assess carcinogenic potential”.

Teratogenic/Reproductive Effects

Some human newborns were found to have hemolytic anemia because of the mothers’ naphthalene exposure. Most animal studies have shown no developmental or reproductive effects after naphthalene exposure. One rabbit study did show a slight increase in developmental effects.

Health Standards and Criteria

The EPA has developed one- and ten-day health advisories for drinking water of 500 micrograms per liter (ug/L = ppb) that will be protective for a young child. The EPA lifetime health advisory is 100 ppb. Lifetime health advisories are calculated based on an average intake of two liters (0.53 gallon) of water per day by a 70-kilogram (154 lb.) adult for 70 years. The state drinking water standard for naphthalene of 20 ppb is based on a rat study in which significantly reduced body weight was observed.

The Occupational Safety and Health Administration enforceable standard (permissible exposure limit or PEL) for naphthalene in workplace air is 10 parts per million (ppm) averaged over an eight-hour exposure period.

Suggested Reading and References

Casarett and Doull's Toxicology: The Basic Science of Poisons, Sixth Edition. Klaassen, C.D., ed. McGraw-Hill Publishing Co., Inc., New York, 2001.

Integrated Risk Information System (IRIS). Information on naphthalene. U.S. EPA, Office of Health and Environmental Assessment.

Toxicological Profile for Naphthalene (Update). Agency for Toxic Substances and Disease Registry (ATSDR). Atlanta, GA. August, 2005.

Drinking Water Health Advisory for Naphthalene. U.S. EPA, Office of Water. March, 1990.

Toxicological Review of Naphthalene. U.S. EPA. Washington, DC. August, 1998.

TR-500 Toxicology and Carcinogenesis Studies of Naphthalene (CAS No. 91-20-3) in F344/N Rats (Inhalation Studies). Abstract from the National Toxicology Program, Dept. of Health and Human Services website: <http://ntp.niehs.nih.gov>.

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